

10,049,930

JC10 Rec'd PCT/PTO 20 FEB 2002

Practitioner's Docket No. AP9703

CHAPTER II

**TRANSMITTAL LETTER  
TO THE UNITED STATES ELECTED OFFICE (EO/US)****(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)**

|                               |                           |                       |
|-------------------------------|---------------------------|-----------------------|
| <u>PCT/EP00/08151</u>         | <u>22/Aug/2000</u>        | <u>25/Aug/1999</u>    |
| INTERNATIONAL APPLICATION NO. | INTERNATIONAL FILING DATE | PRIORITY DATE CLAIMED |

Pressure Control Valve  
TITLE OF INVENTIONAndreas Klein  
APPLICANT(S)**Box PCT**  
**Assistant Commissioner for Patents**  
**Washington D.C. 20231**  
**ATTENTION: EO/US**

*NOTE.* To avoid abandonment of the application, the applicant shall furnish to the USPTO, not later than 20 months from the priority date: (1) a copy of the international application, unless it has been previously communicated by the International Bureau or unless it was originally filed in the USPTO, and (2) the basic national fee (see 37 C.F.R. § 1.492(a)). The 30-month time limit may not be extended. 37 C.F.R. § 1.495

**WARNING:** Where the items are those which can be submitted to complete the entry of the international application into the

**CERTIFICATION UNDER 37 C.F.R. 1.10\***(Express Mail label number is **mandatory**)

(Express Mail certification is optional)

I hereby certify that this correspondence and the documents referred to as attached therein are being deposited with the United States Postal Service on this date 2/20/02, in an envelope as "Express Mail Post Office to Addressee," Mailing Label Number EV051019108US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Joyce Krumpke

(type or print name of person mailing paper)

Joyce Krumpke  
Signature of person mailing paper

**WARNING:** Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence

**\*WARNING:** Each paper or fee filed by "Express Mail" **must** have the number of the "Express Mail" mailing label placed thereon prior to mailing 37 C.F.R. 1.10(b)  
"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will not be granted on petition." Notice of Oct 24, 1996, 60 Fed. Reg. 56,439, at 56,442

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*national phase are subsequent to 30 months from the priority date the application is still considered to be in the international state and if mailing procedures are utilized to obtain a date the express mail procedure of 37 C F R §1.10 must be used (since international application papers are not covered by an ordinary certificate of mailing - See 37 C F R. §1 8*

*NOTE Documents and fees must be clearly identified as a submission to enter the national state under 35 USC 371 otherwise the submission will be considered as being made under 35 USC 111 37 C F R § 1 494(f)*

1. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. 371:

- a. ☒ This express request to immediately begin national examination procedures (35 U.S.C. 371(f)).
- b. ☒ The U.S. National Fee (35 U.S.C. 371(c)(1)) and other fees (37 C.F.R. § 1.492) as indicated below:

2.Fees

| CLAIMS FEE   | (1) FOR  | (2) NUMBER FILED | (3) NUMBER EXTRA | (4) RATE     | (5) CALCULATIONS |
|--------------|--|------------------|------------------|--------------|------------------|
| [ ]*         | TOTAL CLAIMS   | 10 - 20 =        |                  | x \$ 18.00 = | \$               |
|              | INDEPENDENT CLAIMS   | 1 - 3 =          |                  | x \$ 84.00 = |                  |
|              | MULTIPLE DEPENDENT CLAIM(S) (if applicable) + \$280.00   |                  |                  |              |                  |
| BASIC FEE**  | <p>[ ] U.S. PTO WAS INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY<br/>Where an International preliminary examination fee as set forth in § 1.482 has been paid on the international application to the U S PTO.<br/>[ ] and the international preliminary examination report states that the criteria of novelty, inventive step (non-obviousness) and industrial activity, as defined in PCT Article 33(2) to (4) have been satisfied for all the claims presented in the application entering the national stage (37 CFR 1.492(a)(4)) ..... \$100.00<br/>[ ] and the above requirements are not met (37 CFR 1.492(a)(1)) ..... \$710.00</p> <p>[X] U S PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY<br/>Where no international preliminary examination fee as set forth in § 1.482 has been paid to the U.S. PTO, and payment of an international search fee as set forth in § 1.445(a)(2) to the U.S. PTO:<br/>[ ] has been paid (37 CFR 1.492(a)(2)) ..... \$740.00<br/>[ ] has not been paid (37 CFR 1.492(a)(3)) ..... \$1040.00<br/>[X] where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 CFR 1.492(a)(5)) ..... \$890.00</p> |                  |                  |              |                  |
|              | Total of above Calculations  |                  |                  |              | = 890.00         |
| SMALL ENTITY | Reduction by ½ for filing by small entity, if applicable Affidavit must be filed. (note 37 CFR 1.9, 1.27, 1.28)  |                  |                  |              | -                |
|              | Subtotal   |                  |                  |              | 890.00           |
|              | Total National Fee   |                  |                  |              | \$ 890.00        |
|              | Fee for recording the enclosed assignment document \$40.00 (37 CFR 1.21(h)). (See Item 13 below) See attached "ASSIGNMENT COVER SHEET".  |                  |                  |              |                  |
| TOTAL        | Total Fees enclosed  |                  |                  |              | \$ 890.00        |

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\*See attached Preliminary Amendment Reducing the Number of Claims.

- i. ☐ A check in the amount of \_\_\_\_\_ to cover the above fees is enclosed.
  - ii. ☒ Please charge Account No. 18-0013 in the amount of \$ 890.00.
- A duplicate copy of this sheet is enclosed.

**\*\*WARNING.** "To avoid abandonment of the application the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 30 months from the priority date \* \* \* (2) the basic national fee (see § 1.492(a)) The 30-month time limit may not be extended." 37 C.F.R. § 1.495(b)

**WARNING.** If the translation of the international application and/or the oath or declaration have not been submitted by the applicant within thirty (30) months from the priority date, such requirements may be met within a time period set by the Office 37 C.F.R. § 1.495(b)(2). The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than thirty (30) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than thirty (30) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 apply to the period which is set Notice of Jan. 3, 1993, 1147 O.G. 29 to 40.

- 3. ☒ A copy of the International application as filed (35 U.S.C. 371(c)(2)):

**NOTE** Section 1.495 (b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 30 months from the priority date to avoid abandonment "The International Bureau normally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage, the applicant normally need only check to be sure the notice from the International Bureau has been received and then pay the basic national fee by 30 months from the priority date." Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35-36. See item 14c below.

- a. ☒ is transmitted herewith.
- b. ☐ is not required, as the application was filed with the United States Receiving Office.
- c. ☐ has been transmitted
  - i. ☐ by the International Bureau.  
Date of mailing of the application (from form PCT/IB/308): \_\_\_\_\_.
  - ii. ☐ by applicant on \_\_\_\_\_.  
Date

- 4. ☒ A translation of the International application into the English language (35 U.S.C. 371(c)(2)):

- a. ☒ is transmitted herewith.
- b. ☐ is not required as the application was filed in English.
- c. ☐ was previously transmitted by applicant on \_\_\_\_\_.  
Date
- d. ☐ will follow.

- 5. ☐ Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. 371(c)(3)):

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NOTE. The Notice of January 7, 1993 points out that 37 C.F.R. § 1.495(a) was amended to clarify the existing and continuing practice that PCT Article 19 amendments must be submitted by 30 months from the priority date and this deadline may not be extended. The Notice further advises that: "The failure to do so will not result in loss of the subject matter of the PCT Article 19 amendments. Applicant may submit that subject matter in a preliminary amendment filed under section 1121. In many cases, filing an amendment under section 1121 is preferable since grammatical or idiomatic errors may be corrected." 1147 O.G. 29-40, at 36.

- a. ☐ are transmitted herewith.
  - b. ☐ have been transmitted
    - i. ☐ by the International Bureau.  
Date of mailing of the amendment (from form PCT/IB/308): \_\_\_\_\_.
    - ii. ☐ by applicant on \_\_\_\_\_.  
Date
  - c. ☐ have not been transmitted as
    - i. ☐ applicant chose not to make amendments under PCT Article 19.  
Date of mailing of Search Report (from form PCT/ISA/210): \_\_\_\_\_.
    - ii. ☐ the time limit for the submission of amendments has not yet expired. The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.
6. ☐ A translation of the amendments to the claims under PCT Article 19 (38 U.S.C. 371(c)(3)):
- a. ☐ is transmitted herewith.
  - b. ☐ is not required as the amendments were made in the English language.
  - c. ☐ has not been transmitted for reasons indicated at point 5(c) above.
7. ☒ A copy of the international examination report (PCT/IPEA/409)  
☒ is transmitted herewith.  
☐ is not required as the application was filed with the United States Receiving Office.
8. ☒ Annex(es) to the international preliminary examination report
- a. ☒ is/are transmitted herewith.
  - b. ☐ is/are not required as the application was filed with the United States Receiving Office.
9. ☐ A translation of the annexes to the international preliminary examination report
- a. ☐ is transmitted herewith.
  - b. ☐ is not required as the annexes are in the English language.
10. ☒ An oath or declaration of the inventor (35 U.S.C. 371(c)(4)) complying with 35 U.S.C. 115
- a. ☐ was previously submitted by applicant on \_\_\_\_\_.  
Date
  - b. ☒ is submitted herewith, and such oath or declaration
    - i. ☒ is attached to the application.
    - ii. ☐ identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3(b) or 3(c) and 5(b); and states that they were reviewed by the inventor as required by 37 C.F.R. 1.70.

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iii. ☐ will follow.

Other document(s) or information included:

11. ☒ An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):

- a. ☒ is transmitted herewith.
- b. ☒ has been transmitted by the International Bureau.  
Date of mailing (from form PCT/IB/308): \_\_\_\_\_.
- c. ☐ is not required, as the application was searched by the United States International Searching Authority.
- d. ☐ will be transmitted promptly upon request.
- e. ☐ has been submitted by applicant on \_\_\_\_\_.  
Date

12. ☒ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98:

- a. ☒ is transmitted herewith.  
Also transmitted herewith is/are:  
☒ Form PTO-1449 (PTO/SB/08A and 08B).  
☒ Copies of citations listed.
- b. ☐ will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. 371(c).
- c. ☐ was previously submitted by applicant on \_\_\_\_\_.  
Date

13. ☒ An assignment document is transmitted herewith for recording.

A separate ☒ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING  
NEW PATENT APPLICATION" or ☐ FORM PTO  
1595 is also attached.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

14. ☒ Additional documents:

- a. ☐ Copy of request (PCT/RO/101)
- b. ☒ International Publication No. WO01/14191
- i. ☐ Specification, claims and drawing
- ii. ☒ Front page only
- c. ☒ Preliminary amendment (37 C.F.R. § 1.121)
- d. ☐ Other
- \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

15. ☒ The above checked items are being transmitted

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- a. ☒ before 30 months from any claimed priority date.  
b. ☐ after 30 months.

16. ☐ Certain requirements under 35 U.S.C. 371 were previously submitted by the applicant on \_\_\_\_\_, namely:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### AUTHORIZATION TO CHARGE ADDITIONAL FEES

**WARNING:** Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges if extra claims are authorized

**NOTE** "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3)

**NOTE** "Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts, amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a)

☒ The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to Account No. 18-0013.

☒ 37 C.F.R. 1.492(a)(1), (2), (3), and (4) (filing fees)

**WARNING:** Because failure to pay the national fee within 30 months without extension (37 C.F.R. § 1.495(b)(2)) results in abandonment of the application, it would be best to always check the above box.

☒ 37 C.F.R. 1.492(b), (c) and (d) (presentation of extra claims)

**NOTE** Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possible when dealing with amendments after final action.

☒ 37 C.F.R. 1.17 (application processing fees)

☒ 37 C.F.R. 1.17(a)(1)-(5) (extension fees pursuant to § 1.136(a)).

☐ 37 C.F.R. 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. 1.311(b))

**NOTE** Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of

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allowance 37 C.F.R. § 1.311(b)

NOTE: 37 C.F.R. 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application prior to paying, or at the time of paying, issue fee." From the wording of 37 C.F.R. § 1.28(b), (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

☒ [X] 37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 30 months after the priority date).

Reg. No.: 33,373

Tel. No.: (248) 594-0650

CUSTOMER NO.: 010291

  
SIGNATURE OF PRACTITIONER

Joseph V. Coppola, Sr.

(type or print name of practitioner)

RADER, FISHMAN & GRAUER PLLC

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Bloomfield Hills, MI 48304



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AP9703

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Klein

Int'l Application No.: PCT/EP00/08151

Int'l Filing Date: 22/August/2000

Serial No.:

Group Art Unit:

Filed:

Herewith

Examiner:

For:

Pressure Control Valve

Attorney Docket No.: AP9703

Paper No.

Box PCT  
Commissioner for Patents  
Washington, D.C. 20231  
Attn: EO/US

| CERTIFICATE OF MAILING/TRANSMISSION (37 CFR 1.8(a))   |  |
|---|--|
| I hereby certify that this correspondence is, on the date shown below, being:   |  |
| <input checked="" type="checkbox"/> deposited with the United States Postal Service   | <input type="checkbox"/> transmitted by facsimile to the Patent and Trademark Office to Examiner _____ at _____ (phone number) |
| _____ first class mail, postage prepaid in an envelope addressed to the Commissioner for Patents, Washington, DC 20231  |  |
| <input checked="" type="checkbox"/> Express Mail, Post Office to Addressee, Mailing Label No. <u>EV 051 019 108 US</u> addressed to the Commissioner for Patents, Washington DC 20231 |  |
| Date: <u>2/20/02</u>  | Signature: <u>[Signature]</u><br>Name: <u>Byce Krumpke</u>   |

**PRELIMINARY AMENDMENT**

Dear Sir:

Please amend the application as follows prior to examination on the merits.

[illegible]

## IN THE DRAWINGS

Please amend Figure 2 as indicated in red on the attached sheet.

## IN THE CLAIMS

Please cancel claims 1-10 and add the following new claims.

11. (New) Pressure control valve with integrated pressure sensor, comprising:  
a valve member arranged in a valve housing,  
a sensor element for generating an output signal that is a function of a fluid pressure reaction of the valve housing, wherein the fluid pressure reaction of the valve housing is determined by the sensor element by using the sensor to detect a deformation of the valve housing.

12. (New) Pressure control valve as claimed in claim 11, further including a signal-receiving and exciter assembly and wherein said sensor element is attached to said valve housing and is wirelessly connected to said signal-receiving and exciter assembly.

13. (New) Pressure control valve as claimed in claim 12, wherein the signal-receiving and exciter assembly couples an electric signal into said sensor element by way of a receiving circuit integrated in the sensor element.

14. (New) Pressure control valve as claimed in claim 13, wherein the sensor element or the signal-receiving and exciter assembly includes a compensating circuit to stabilize the signal strength of the output signal of the sensor element.

15. (New) Pressure control valve as claimed in claim 13, wherein the sensor element includes a gauge element and a reference circuit having a reference output signal, and wherein an output signal of the gauge element is combined with the reference output signal to comprise the sensor element output signal.

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16. (New) Pressure control valve as claimed in claim 11, wherein the valve housing includes an area made from a thin walled sleeve and wherein the sensor element is arranged on said thin-walled sleeve.

17. (New) Pressure control valve as claimed in claim 16, wherein the sensor element includes a gauge ring, a reference ring, and a wire gauge strain.

18. (New) Pressure control valve as claimed in claim 17, further including an exciter ring coaxially aligned with said gauge ring and said reference ring.

19. (New) Pressure control valve as claimed in claim 18, further including a cover which accommodates a controlling or regulating electronics that is required for the operation of the pressure control valve and is electrically and mechanically connected to several electric contacts of a valve coil of the valve member.

20. (New) Pressure control valve as claimed in claim 19, wherein the valve coil, the controlling or regulating electronics, and a signal-receiving and exciter assembly are combined to form a prefabricated subassembly in the cover.

### **REMARKS**

Prior to a formal examination of the above-identified application, acceptance of the new claims and the enclosed substitute specification (under 37 CFR 1.125) is respectfully requested. It is believed that the substitute specification and new claims will facilitate processing of the application in accordance with M.P.E.P. 608.01(q). The substitute specification and new claims are in compliance with 37 CFR 1.52 (a and b) and, while making no substantive changes, are submitted to conform this case to the formal requirements and long-established formal standards of U.S. Patent Office practice, and to provide improved idiom and better grammatical form.

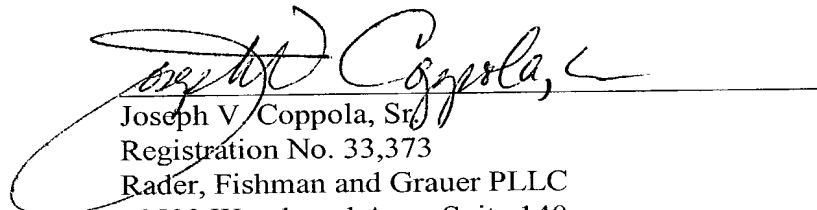
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The enclosed substitute specification is presented herein in both marked-up and clean versions.

**STATEMENT**

The undersigned, an attorney registered to practice before the office, hereby states that the enclosed substitute specification includes the same changes as are indicated in the mark-up copy of the original specification. The substitute specification contains no new subject matter.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Joseph V. Coppola, Sr.", is written over a horizontal line. The signature is fluid and cursive, with a large loop at the beginning and a trailing flourish at the end.

Joseph V. Coppola, Sr.  
Registration No. 33,373  
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39533 Woodward Ave., Suite 140  
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(248) 594-0650  
Attorney for Applicants  
CUSTOMER NO. 010291

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Fig. 1

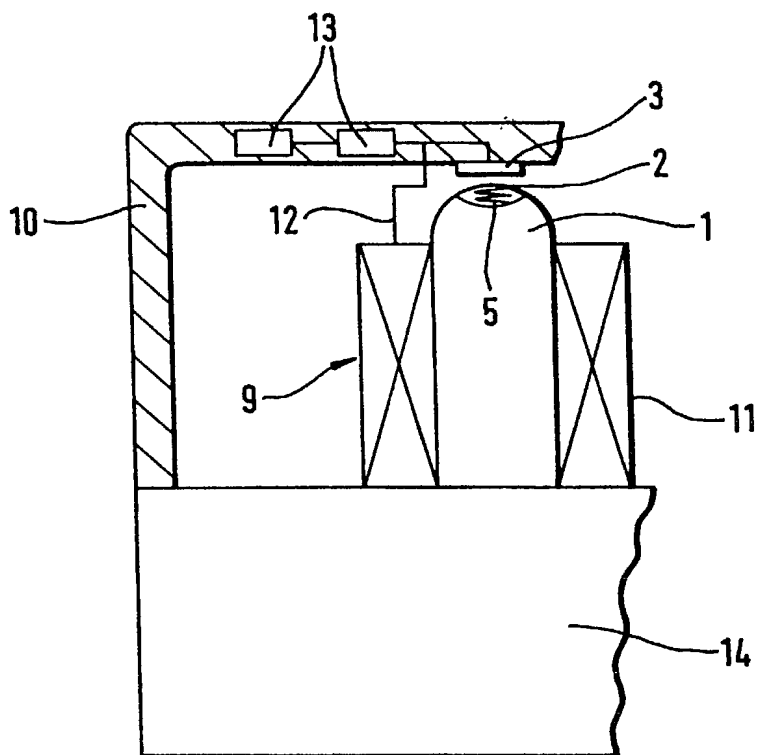
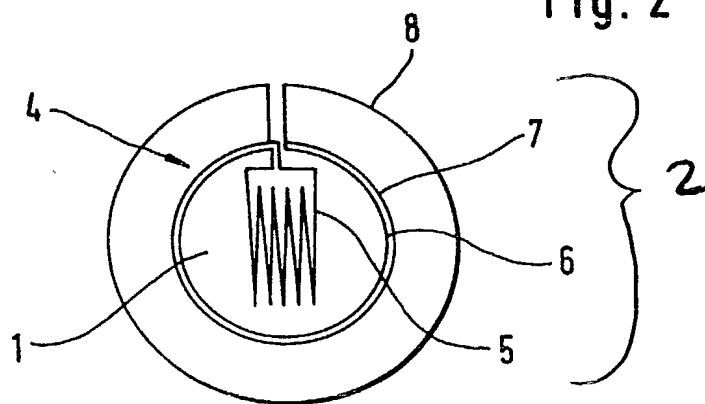


Fig. 2



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SUBSTITUTE SPECIFICATION: CLEAN COPY

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## Pressure Control Valve

### Technical Field

[0001] The present invention generally relates to valves and more particularly relates to a pressure control valve for use in electrohydraulic brake systems.

### Background of The Invention

[0002] WO 00/02755A which was published after the priority date of the present invention discloses a pressure control valve of this type which includes a valve member arranged in a valve housing and a sensor element for determining the fluid pressure that prevails in the valve housing. The fluid pressure is determined directly by the arrangement of the sensor element in the valve housing, to what end corresponding structural provisions are necessary which also affect the overall dimensions of the pressure control valve. Due to the relatively high operating pressure, a correspondingly expensive sensor system is generally required which is permanently exposed to high pressures.

[0003] From generic publication WO 96/33080A a brake system with an electronic brake pressure control is known which is equipped with an impact sound sensor by means of which the change-over behavior of several pressure control valves of the brake system is established for the approximate determination of the brake pressure that prevails in a brake pressure generator and/or in several wheel brakes. To this end, the impact sound sensor is respectively arranged at a location of the valve housing of a pressure control valve such that the





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[0007] Figure 2 shows an embodiment for the design of a sensor element for the assembly presented in Figure 1.

### Detailed Description of The Preferred Embodiments

[0008] Figure 1 shows a simplified view of a pressure control valve 9 which is arranged in a block-shaped valve-accommodating member 14 and is especially suited for use in electrohydraulic brake systems. The pressure control valve 9 accommodates in a valve housing 1 a valve member which is adapted to close or open the pressure fluid channels disposed in the valve accommodating member 14 by way of the electromagnetic actuation of a valve coil 11.

[0009] Further, a sensor element 2 is arranged above the valve coil 11 on the outside of the dome-shaped valve sleeve area. Sensor element 2 is used to determine the fluid pressure which prevails in the pressure control valve 9. According to the present invention, the fluid pressure in the valve housing 1 is indirectly sensed by the sensor element 2 by way of the measurement of the deformation of the valve housing. As regards the design of the sensor element 2, it becomes apparent from Figure 1 that a wire strain gauge 5 is fitted to the dome-shaped portion of the valve housing 1 and, in conjunction with a gauge ring 6 and reference ring 7 that will be illustrated in the following in Figure 2, forms a measuring element 4 which, by way of exciter ring 8, senses a signal representative of the deformation of the valve housing in the event of hydraulic pressure variation and transforms it into a pressure signal by way of an appropriate sensing and evaluating circuit.

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[0010] According to Figure 1, the signal-receiving and exciter assembly 3 is mounted directly on a cover 10 which also accommodates the controlling and/or regulating electronics 13 that is required for the operation of the pressure control valve 9. Electronics 13 is connected electrically and also mechanically by way of the electric contacts 12 of the valve coil 11. Valve coil 11, the controlling and/or regulating electronics 13, and the signal-receiving and exciter assembly 3 are thus combined to form a prefabricated assembly in the cover 10. Cover 10 is seated on the valve-accommodating member 14 that carries the pressure control valve 9. It can be seen in the drawing of Figure 1 that the sensor element 2 is isolated by an air gap from the signal-receiving and exciter assembly 3 so that a non-contact signal transmission occurs between a measuring element 4, that is integrated in the sensor element 2 and fitted to the pressure control valve 9, and the signal-receiving and exciter assembly 3 in which the sensor signal characterizing the valve housing deformation is transformed into a pressure signal. Therefore, it is proposed for the operation of the sensor element 2 that the signal-receiving and exciter assembly 3 causes induction of an electric voltage in a receiving circuit integrated in the sensor element 2, the said voltage permitting the operation of the measuring element 4 associated with the sensor element 2.

[0011] Upon request or requirement, the sensor element 2 and the signal-receiving and exciter assembly 3 may be provided with a corresponding signal amplifying and/or compensating circuit in order to stabilize the quality of signal transmission.

[0012] With a view to ensuring a precisest possible signal determination and signal transmission with respect to possible



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ring. Induced current also passes through the gauge ring 6 and reference ring 7 so that the thus produced magnetic fields of the rings 6, 7 can be sensed by means of appropriate sensor elements, for example, by means of Hall elements. Consequently, two sensor signals are available that allow to determine the deformation of the valve housing 1 and, thus, the pressure prevailing in the pressure control valve 9.

[0016] An arrangement of this type is suited especially for electrohydraulic brake systems necessitating a large number of sensor elements 2 which may be accommodated between the valve-accommodating member 14 and a cover 10 that includes the controlling and regulating electronics 13 and is seated on the valve-accommodating member 14. Another case of application is for traction slip and driving dynamics control systems in automotive vehicle brake systems.

[illegible]

## Pressure Control Valve

## Abstract of The Disclosure

[0017] The present invention relates to a pressure control valve, in particular for electrohydraulic brake systems, including a valve member arranged in a valve housing and a sensor element for determining the fluid pressure that prevails in the valve housing. The fluid pressure in the valve housing is indirectly determined by the sensor element by way of the measurement of the deformation of the valve housing.

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**SUBSTITUTE SPECIFICATION: MARKED UP COPY**

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[PC 9703]**Pressure Control Valve****Technical Field**

The present invention generally relates to valves and more particularly relates to a pressure control valve[, in particular] for use in electrohydraulic brake systems [according to the preamble of patent claim 1].

**Background of The Invention**

WO 00/02755A which was published after the priority date of the present invention discloses a pressure control valve of this type which includes a valve member arranged in a valve housing and a sensor element for determining the fluid pressure that prevails in the valve housing. The fluid pressure is determined directly by the arrangement of the sensor element in the valve housing, to what end corresponding structural provisions are necessary which also affect the overall dimensions of the pressure control valve. Due to the relatively high operating pressure, a correspondingly expensive sensor system is generally required which is permanently exposed to high pressures.

From generic publication WO 96/33080A a brake system with an electronic brake pressure control is known which is equipped with an impact sound sensor by means of which the change-over behavior of several pressure control valves of the brake system is established for the approximate determination of the brake pressure that prevails in a brake pressure generator and/or in several wheel brakes. To this end, the impact sound

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sensor is respectively arranged at a location of the valve housing of a pressure control valve such that the impact sound which is caused when a valve tappet or a valve head gets into contact on the valve housing is transmitted undamped to the impact sound sensor. Consequently, the impact sound sensor exclusively senses the vibrations which are transmitted onto the valve housing by the mechanical impulse of the moved valve components.

DE 198 30 464 A1 discloses a pressure control valve of this type which includes a valve member arranged in a valve housing and a sensor element for determining the fluid pressure that prevails in the valve housing. The fluid pressure is determined directly by the arrangement of the sensor element in the valve housing, to what end corresponding structural provisions are necessary which also affect the overall dimensions of the pressure control valve. Due to the relatively high operating pressure, a correspondingly expensive sensor system is generally required which is permanently exposed to high pressures.

In view of the above, an object of the present invention is to configure a pressure control valve of the type initially referred to in such a way that a low-cost determination of the hydraulic pressure that acts in the pressure control valve is ensured by entailing relatively low structural and functional efforts.

[According to the present invention, this object is achieved for a pressure control valve of the indicated type by the characterizing features of patent claim 1.

Further features, advantages, and possible applications of the present invention can be taken in the following from the



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description of two embodiments by making reference to Figures 1 and 2.

In the drawing,]

### Brief Description of The Drawings

Figure 1 is a basic circuit diagram of the sensor assembly that is essential to the present invention.

Figure 2 shows an embodiment for the design of a sensor element for the assembly presented in Figure 1.

### Detailed Description of The Preferred Embodiments

Figure 1 shows a simplified view of a pressure control valve 9 which is arranged in a block-shaped valve-accommodating member 14 and is especially suited for use in electrohydraulic brake systems. The pressure control valve 9 accommodates in a valve housing 1 a valve member which is adapted to close or open the pressure fluid channels disposed in the valve accommodating member 14 by way of the electromagnetic actuation of a valve coil 11.

Further, a sensor element 2 is arranged above the valve coil 11 on the outside of the dome-shaped valve sleeve area. Sensor element 2 is used to determine the fluid pressure which prevails in the pressure control valve 9. According to the present invention, the fluid pressure in the valve housing 1 is indirectly sensed by the sensor element 2 by way of the measurement of the deformation of the valve housing. As

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regards the design of the sensor element 2, it becomes apparent from Figure 1 that a wire strain gauge 5 is fitted to the dome-shaped portion of the valve housing 1 and, in conjunction with a gauge ring 6 and reference ring 7 that will be illustrated in the following in Figure 2, forms a measuring element 4 which, by way of exciter ring 8, senses a signal representative of the deformation of the valve housing in the event of hydraulic pressure variation and transforms it into a pressure signal by way of an appropriate sensing and evaluating circuit.

According to Figure 1, the signal-receiving and exciter assembly 3 is mounted directly on a cover 10 which also accommodates the controlling and/or regulating electronics 13 that is required for the operation of the pressure control valve 9. Electronics 13 is connected electrically and also mechanically by way of the electric contacts 12 of the valve coil 11. Valve coil 11, the controlling and/or regulating electronics 13, and the signal-receiving and exciter assembly 3 are thus combined to form a prefabricated assembly in the cover 10. Cover 10 is seated on the valve-accommodating member 14 that carries the pressure control valve 9. It can be seen in the drawing of Figure 1 that the sensor element 2 is isolated by an air gap from the signal-receiving and exciter assembly 3 so that a non-contact signal transmission occurs between a measuring element 4, that is integrated in the sensor element 2 and fitted to the pressure control valve 9, and the signal-receiving and exciter assembly 3 in which the sensor signal characterizing the valve housing deformation is transformed into a pressure signal. Therefore, it is proposed for the operation of the sensor element 2 that the signal-receiving and exciter assembly 3 causes induction of an electric voltage in a receiving circuit integrated in the

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sensor element 2, the said voltage permitting the operation of the measuring element 4 associated with the sensor element 2.

Upon request or requirement, the sensor element 2 and the signal-receiving and exciter assembly 3 may be provided with a corresponding signal amplifying and/or compensating circuit in order to stabilize the quality of signal transmission.

With a view to ensuring a precisest possible signal determination and signal transmission with respect to possible air gap tolerances between the sensor element 2 and the signal-receiving and exciter assembly 3, it is disclosed that the sensor element 2 is not only equipped with a measuring element 4 but with a suitable reference circuit in addition.

A specific embodiment which ensures a stable signal transmission quality irrespective of the size of the air gap that exists between the valve dome and the cover 10 shall be represented in the following by way of Figure 2.

Figure 2 shows an expedient design of the sensor element 2 which is hinted at in Figure 1 already. The sensor element 2 is shown in a top view on the valve dome of the valve housing 1. The valve dome represents the area of the pressure control valve 9 which is sensitive to deformation under the effect of the hydraulic pressure.

The sensor element 2 which is aligned concentrically to the valve axis comprises in detail a reference ring 7 and a gauge ring 6 connected to a wire strain gauge 5, the said parts being mounted onto the thin-walled sleeve area of the valve housing 1. Exciter ring 8 is arranged equally coaxially relative to the sensor element 2 and spaced from the pressure control valve 9 by the air gap. The exciter ring 8 along with

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the signal-receiving and exciter assembly 3 forms a construction unit which is arranged in the cover 10 spaced from the pressure control valve 9. In the exciter ring 8, the signal-receiving and exciter assembly 3 induces a voltage which is conducted through the reference ring 7 to a certain extent and through the gauge ring 6 to the wire strain gauge 5 to another extent. The reference ring 7 and the gauge ring 6, in turn, induce magnetic fields which are received by way of the exciter ring 8. The field induction in the exciter ring 8 causes the circulation of an alternating current through the ring. Induced current also passes through the gauge ring 6 and reference ring 7 so that the thus produced magnetic fields of the rings 6, 7 can be sensed by means of appropriate sensor elements, for example, by means of Hall elements. Consequently, two sensor signals are available that allow to determine the deformation of the valve housing 1 and, thus, the pressure prevailing in the pressure control valve 9.

An arrangement of this type is suited especially for electrohydraulic brake systems necessitating a large number of sensor elements 2 which may be accommodated between the valve-accommodating member 14 and a cover 10 that includes the controlling and regulating electronics 13 and is seated on the valve-accommodating member 14. Another case of application is for traction slip and driving dynamics control systems in automotive vehicle brake systems.

[illegible]

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[List of Reference Numerals:

- |    |   |
|----|---|
| 1  | valve housing                             |
| 2  | sensor element                            |
| 3  | signal-receiving and exciter assembly     |
| 4  | measuring element                         |
| 5  | wire strain gauge                         |
| 6  | gauge ring                                |
| 7  | reference ring                            |
| 8  | exciter ring                              |
| 9  | pressure control valve                    |
| 10 | cover                                     |
| 11 | valve coil                                |
| 12 | contact                                   |
| 13 | controlling and/or regulating electronics |
| 14 | valve-accommodating member]               |

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[Abstract:]

## Pressure Control Valve

### Abstract of The Disclosure

The present invention relates to a pressure control valve, in particular for electrohydraulic brake systems, including a valve member arranged in a valve housing [(1)] and a sensor element [(2)] for determining the fluid pressure that prevails in the valve housing [(1)]. The fluid pressure in the valve housing [(1)] is indirectly determined by the sensor element [(2)] by way of the measurement of the deformation of the valve housing.

[Figure 1]

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JC10 Rec'd PCT/PTO 20 FEB 2002  
PC 9703

1/pPTS

## Pressure Control Valve

The present invention relates to a pressure control valve, in particular for electrohydraulic brake systems according to the preamble of patent claim 1.

DE 198 30 464 A1 discloses a pressure control valve of this type which includes a valve member arranged in a valve housing and a sensor element for determining the fluid pressure that prevails in the valve housing. The fluid pressure is determined directly by the arrangement of the sensor element in the valve housing, to what end corresponding structural provisions are necessary which also affect the overall dimensions of the pressure control valve. Due to the relatively high operating pressure, a correspondingly expensive sensor system is generally required which is permanently exposed to high pressures.

In view of the above, an object of the present invention is to configure a pressure control valve of the type initially referred to in such a way that a low-cost determination of the hydraulic pressure that acts in the pressure control valve is ensured by entailing relatively low structural and functional efforts.

According to the present invention, this object is achieved for a pressure control valve of the indicated type by the characterizing features of patent claim 1.

Further features, advantages, and possible applications of the present invention can be taken in the following from the description of two embodiments by making reference to Figures 1 and 2.

In the drawing,

Figure 1 is a basic circuit diagram of the sensor assembly that is essential to the present invention.

Figure 2 shows an embodiment for the design of a sensor element for the assembly presented in Figure 1.

Figure 1 shows a simplified view of a pressure control valve 9 which is arranged in a block-shaped valve-accommodating member 14 and is especially suited for use in electrohydraulic brake systems. The pressure control valve 9 accommodates in a valve housing 1 a valve member which is adapted to close or open the pressure fluid channels disposed in the valve accommodating member 14 by way of the electromagnetic actuation of a valve coil 11.

Further, a sensor element 2 is arranged above the valve coil 11 on the outside of the dome-shaped valve sleeve area. Sensor element 2 is used to determine the fluid pressure which prevails in the pressure control valve 9. According to the present invention, the fluid pressure in the valve housing 1 is indirectly sensed by the sensor element 2 by way of the measurement of the deformation of the valve housing. As regards the design of the sensor element 2, it becomes apparent from Figure 1 that a wire strain gauge 5 is fitted to the dome-shaped portion of the valve housing 1 and, in conjunction with a gauge ring 6 and reference ring 7 that will be illustrated in the following in Figure 2, forms a measuring element 4 which, by way of exciter ring 8, senses a signal representative of the deformation of the valve housing in the event of hydraulic pressure variation and transforms it into a pressure signal by way of an appropriate sensing and evaluating circuit.



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According to Figure 1, the signal-receiving and exciter assembly 3 is mounted directly on a cover 10 which also accommodates the controlling and/or regulating electronics 13 that is required for the operation of the pressure control valve 9. Electronics 13 is connected electrically and also mechanically by way of the electric contacts 12 of the valve coil 11. Valve coil 11, the controlling and/or regulating electronics 13, and the signal-receiving and exciter assembly 3 are thus combined to form a prefabricated assembly in the cover 10. Cover 10 is seated on the valve-accommodating member 14 that carries the pressure control valve 9. It can be seen in the drawing of Figure 1 that the sensor element 2 is isolated by an air gap from the signal-receiving and exciter assembly 3 so that a non-contact signal transmission occurs between a measuring element 4, that is integrated in the sensor element 2 and fitted to the pressure control valve 9, and the signal-receiving and exciter assembly 3 in which the sensor signal characterizing the valve housing deformation is transformed into a pressure signal. Therefore, it is proposed for the operation of the sensor element 2 that the signal-receiving and exciter assembly 3 causes induction of an electric voltage in a receiving circuit integrated in the sensor element 2, the said voltage permitting the operation of the measuring element 4 associated with the sensor element 2.

Upon request or requirement, the sensor element 2 and the signal-receiving and exciter assembly 3 may be provided with a corresponding signal amplifying and/or compensating circuit in order to stabilize the quality of signal transmission.

With a view to ensuring a precisest possible signal determination and signal transmission with respect to possible air gap tolerances between the sensor element 2 and the signal-receiving and exciter assembly 3, it is disclosed that the

sensor element 2 is not only equipped with a measuring element 4 but with a suitable reference circuit in addition.

A specific embodiment which ensures a stable signal transmission quality irrespective of the size of the air gap that exists between the valve dome and the cover 10 shall be represented in the following by way of Figure 2.

Figure 2 shows an expedient design of the sensor element 2 which is hinted at in Figure 1 already. The sensor element 2 is shown in a top view on the valve dome of the valve housing 1. The valve dome represents the area of the pressure control valve 9 which is sensitive to deformation under the effect of the hydraulic pressure.

The sensor element 2 which is aligned concentrically to the valve axis comprises in detail a reference ring 7 and a gauge ring 6 connected to a wire strain gauge 5, the said parts being mounted onto the thin-walled sleeve area of the valve housing 1. Exciter ring 8 is arranged equally coaxially relative to the sensor element 2 and spaced from the pressure control valve 9 by the air gap. The exciter ring 8 along with the signal-receiving and exciter assembly 3 forms a construction unit which is arranged in the cover 10 spaced from the pressure control valve 9. In the exciter ring 8, the signal-receiving and exciter assembly 3 induces a voltage which is conducted through the reference ring 7 to a certain extent and through the gauge ring 6 to the wire strain gauge 5 to another extent. The reference ring 7 and the gauge ring 6, in turn, induce magnetic fields which are received by way of the exciter ring 8. The field induction in the exciter ring 8 causes the circulation of an alternating current through the ring. Induced current also passes through the gauge ring 6 and reference ring 7 so that the thus produced magnetic fields of the rings 6, 7 can be sensed by means of appropriate sensor elements, for

An arrangement of this type is suited especially for electrohydraulic brake systems necessitating a large number of sensor elements 2 which may be accommodated between the valve-accommodating member 14 and a cover 10 that includes the controlling and regulating electronics 13 and is seated on the valve-accommodating member 14. Another case of application is for traction slip and driving dynamics control systems in automotive vehicle brake systems.

List of Reference Numerals:

- 1 valve housing
- 2 sensor element
- 3 signal-receiving and exciter assembly
- 4 measuring element
- 5 wire strain gauge
- 6 gauge ring
- 7 reference ring
- 8 exciter ring
- 9 pressure control valve
- 10 cover
- 11 valve coil
- 12 contact
- 13 controlling and/or regulating electronics
- 14 valve-accommodating member



5. Pressure control valve as claimed in claim 3,  
c h a r a c t e r i z e d in that the gauge element (4) includes a reference circuit, preferably a resistance connection in the form of a wire gauge strain (5) fitted to the valve housing (1), and the measuring element signal and the reference signal of the wire gauge strain (5) representative of the valve housing deformation are transformed into a pressure signal by means of a signal-determination and evaluation circuit.
6. Pressure control valve as claimed in any one of the preceding claims,  
c h a r a c t e r i z e d in that the sensor element (2) is arranged at a deformation-sensitive area of the valve housing (1), preferably in the area of a thin-walled valve sleeve.
7. Pressure control valve as claimed in claim 6,  
c h a r a c t e r i z e d in that the sensor element (2) includes a gauge ring (6) and a reference ring (7) connected to a wire gauge strain (5), the said parts being preferably attached to the thin-walled sleeve area of the valve housing (1).
8. Pressure control valve as claimed in claim 7,  
c h a r a c t e r i z e d in that an exciter ring (8) is arranged so as to be coaxially spaced from the sensor element (2) and, along with a signal-receiving and exciter assembly (3), forms a construction unit which is arranged in a cover (10) spaced from the pressure control valve (9).
9. Pressure control valve as claimed in claim 8,  
c h a r a c t e r i z e d in that the cover (10) accommodates a controlling and/or regulating electronics

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(13) that is required for the operation of the pressure control valve (9) and is electrically and mechanically connected to several electric contacts (12) of a valve coil (11) of the pressure control valve (9).

10. Pressure control valve as claimed in claim 9,  
c h a r a c t e r i z e d in that the valve coil (11),  
the controlling and/or regulating electronics (13), and  
the signal-receiving and exciter assembly (3) are combined  
to form a prefabricated subassembly in the cover (10)  
which latter is mounted onto a valve-accommodating member  
(14) that carries the pressure control valve (9).

Abstract:

Pressure Control Valve

The present invention relates to a pressure control valve, in particular for electrohydraulic brake systems, including a valve member arranged in a valve housing (1) and a sensor element (2) for determining the fluid pressure that prevails in the valve housing (1). The fluid pressure in the valve housing (1) is indirectly determined by the sensor element (2) by way of the measurement of the deformation of the valve housing.

Figure 1



Fig. 1

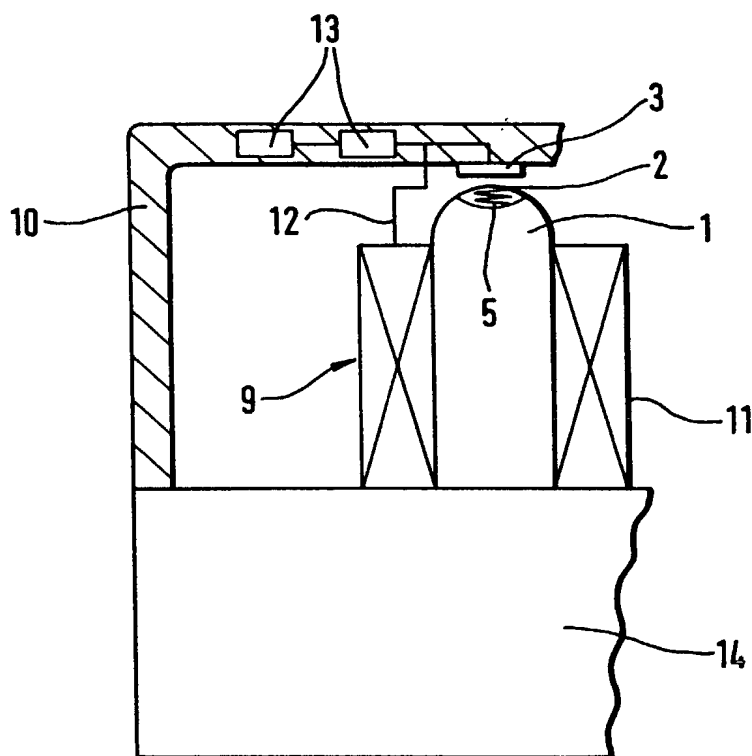
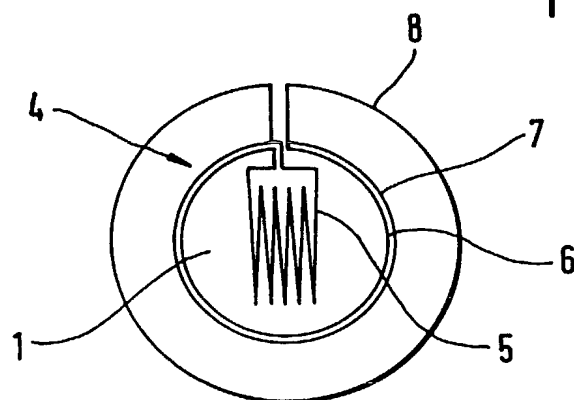


Fig. 2



EXPRESS MAIL EV051019108US

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As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

#### Pressure Control Valve

the specification of which is attached hereto unless the following box is checked:

- ☒ was filed on 08/22/2000 as United States Application Number or PCT International Application Number PCT/EP00/08151

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above and as amended in a preliminary amendment.

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Prior Foreign Applications  
(Frühere ausländische Anmeldungen)

Priority Not Claimed  
Priorität nicht beansprucht

19940257.4                      Germany  
10005489.7                      Germany

25/Aug/1999  
08/Feb/2000



Number                      Country

Day/Month/Year Filed



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Application No.                      , filed on

Status: patented/pending/abandoned)

Application No.                      , filed on

Status: patented/pending/abandoned)

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3- Joseph V. Coppola 33,373  
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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:


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| Signature Date<br>State/Country<br>Citizen of Germany  |  | Signature Date<br>Street Address<br>City<br>State/Country<br>Citizen of                       |  |

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